# *BALANCING SURVIVABILITY ATTRIBUTES: THE COST OF MISSION SUCCESS*

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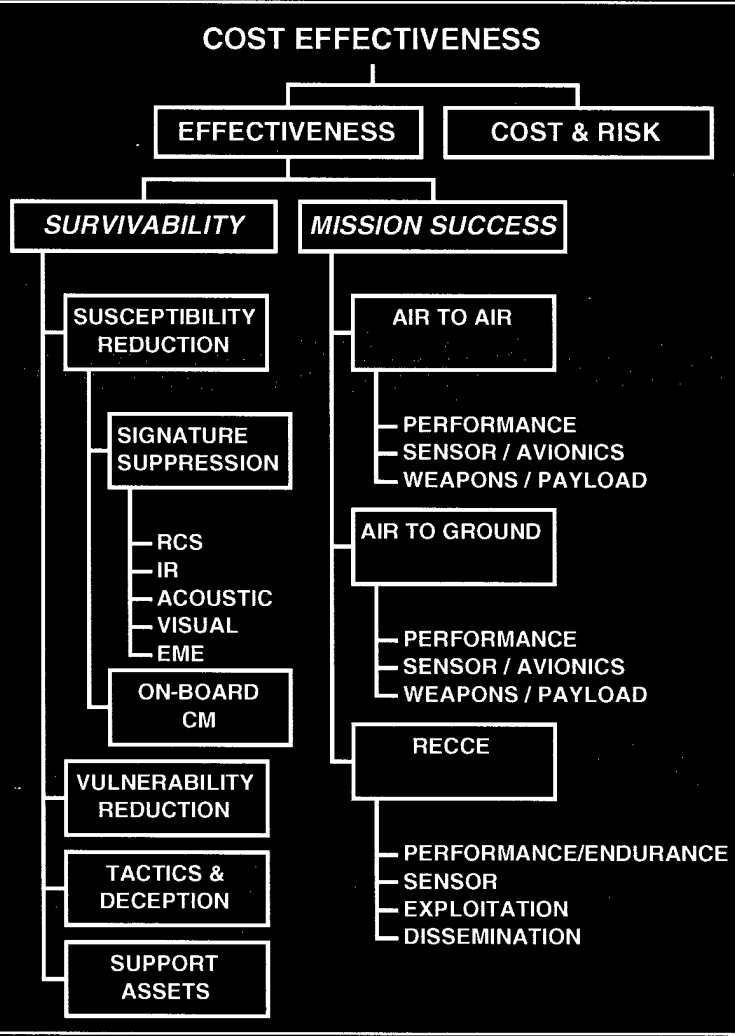
# THE COST OF MISSION SUCCESS

- **BALANCING THE SURVIVABILITY ATTRIBUTES**
  - CHALLENGES
  - TOOLS
  - APPLICATIONS
- **VULNERABILITY IN THE BALANCE**
  - NEW PARADIGM
  - ANALYSIS REQUIREMENTS
  - VULNERABILITY ANALYSIS AS A REQUIREMENT SOURCE
- **THE CRITICAL ELEMENT: COST**

# BALANCING WEAPON SYSTEM ATTRIBUTES

**EFFECTIVE, AFFORDABLE WEAPON SYSTEMS INCORPORATE ALL THE NECESSARY SURVIVABILITY AND MISSION SUCCESS ATTRIBUTES TO THE EXTENT THAT THEY CONTRIBUTE TO MISSION SUCCESS**

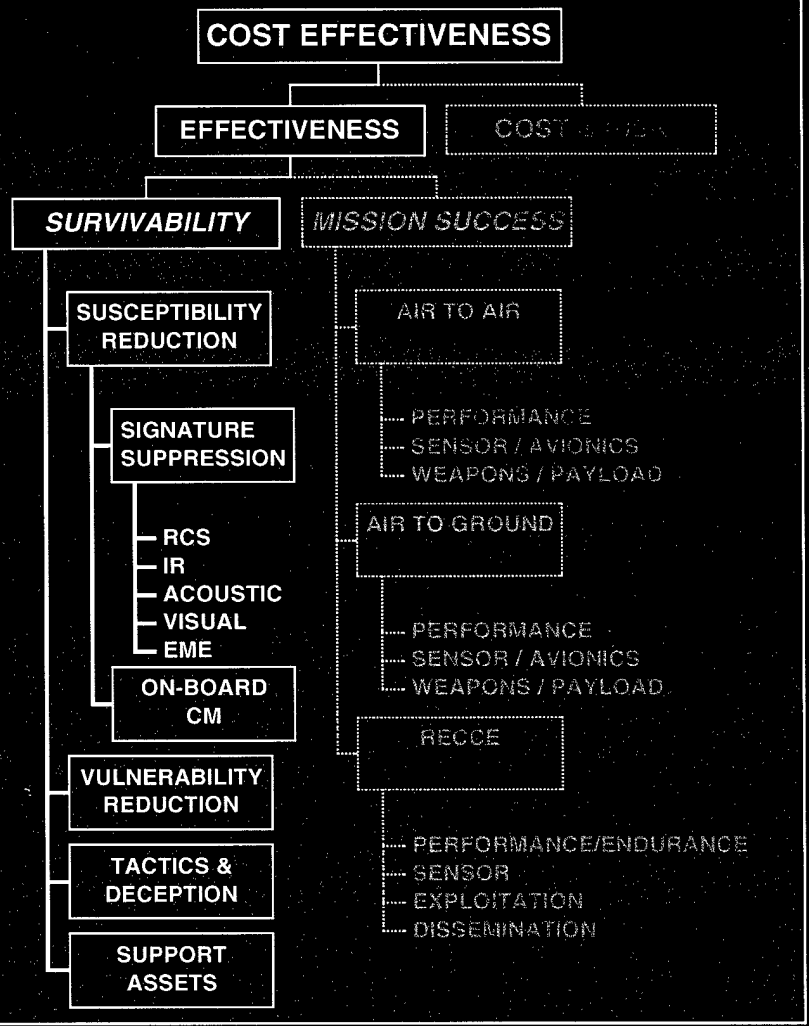


# BALANCING SURVIVABILITY ATTRIBUTES

**BALANCING ATTRIBUTES WRT**

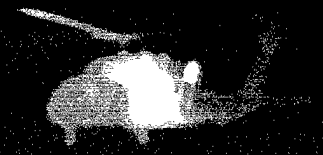
- MISSION NEEDS
- EACH OTHER

**TO ACHIEVE LOWEST COST OF MISSION SUCCESS**



# BALANCED IR REQUIREMENTS

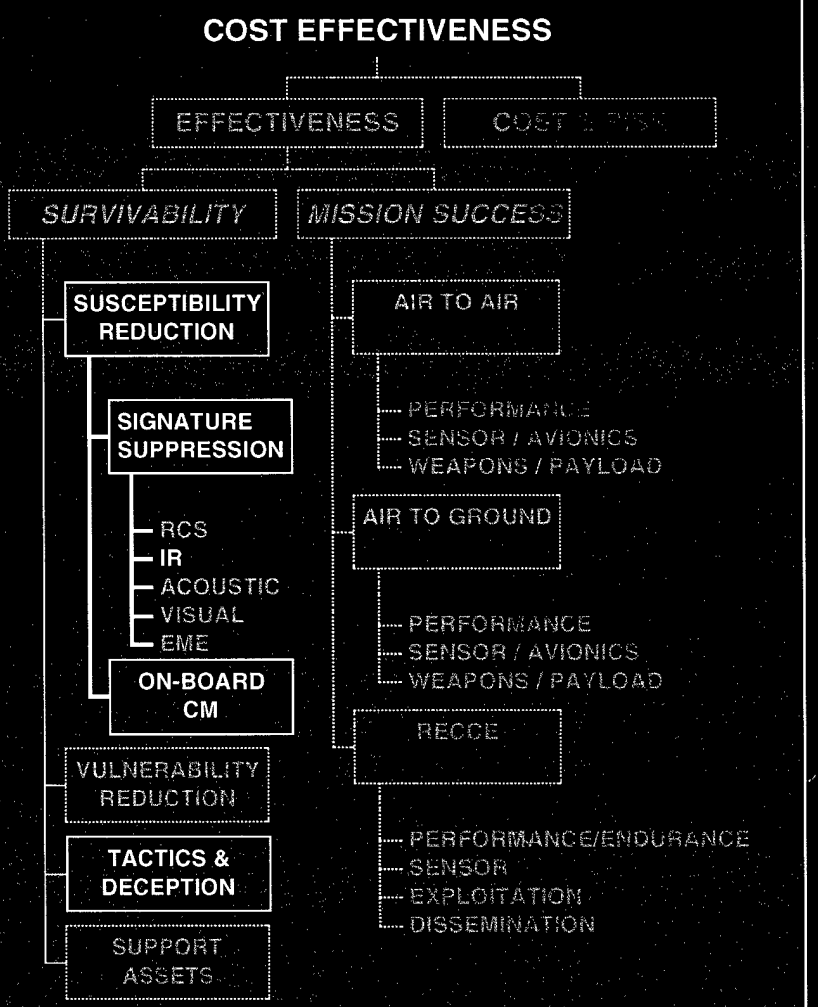
- **INCREASING COMPLEXITY OF REQUIREMENTS...**
  - IRCM WAS EFFECTIVE AND WAS CHEAPER THAN SUPPRESSION
  - AVAILABILITY OF IR WEAPONS
  - PROLIFERATIONS OF MISSILE TYPES AND TECHNOLOGIES



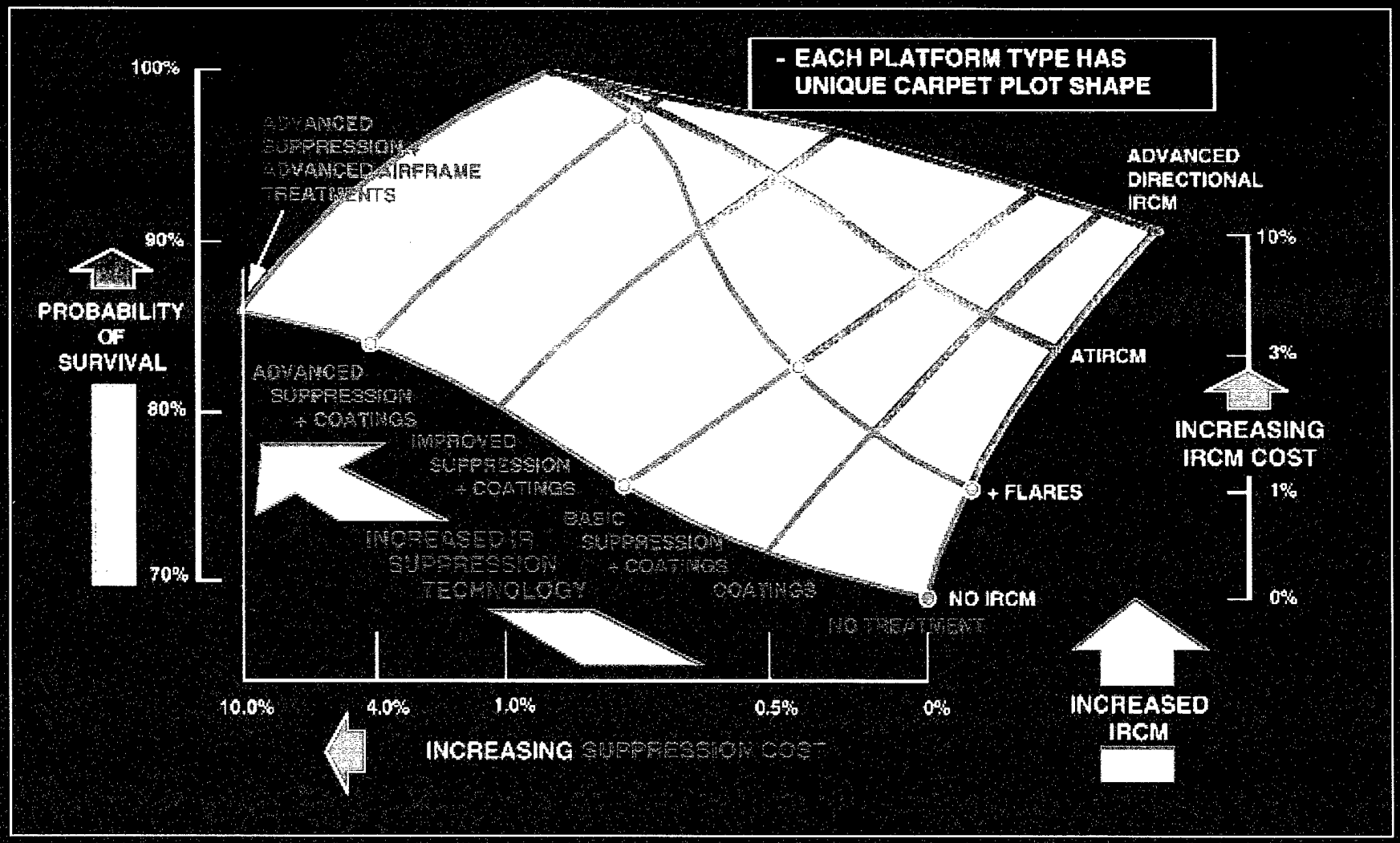
- **... NECESSITATES NEW TECHNIQUES AND METHODOLOGIES**
  - SIGNATURE SPECIFICATION TO SURVIVABILITY REQUIREMENT
  - NEW ANALYSIS TOOLS AND IMPROVED OLD ONES
    - **DETAILED IRCM**
    - **EXTENDED SOURCE IMAGE CAPABILITY**
    - **CONSISTANT DATABASES**
  - FLOW UP AND FLOW DOWN OF REQUIREMENTS

# SURVIVABILITY IMPROVEMENTS

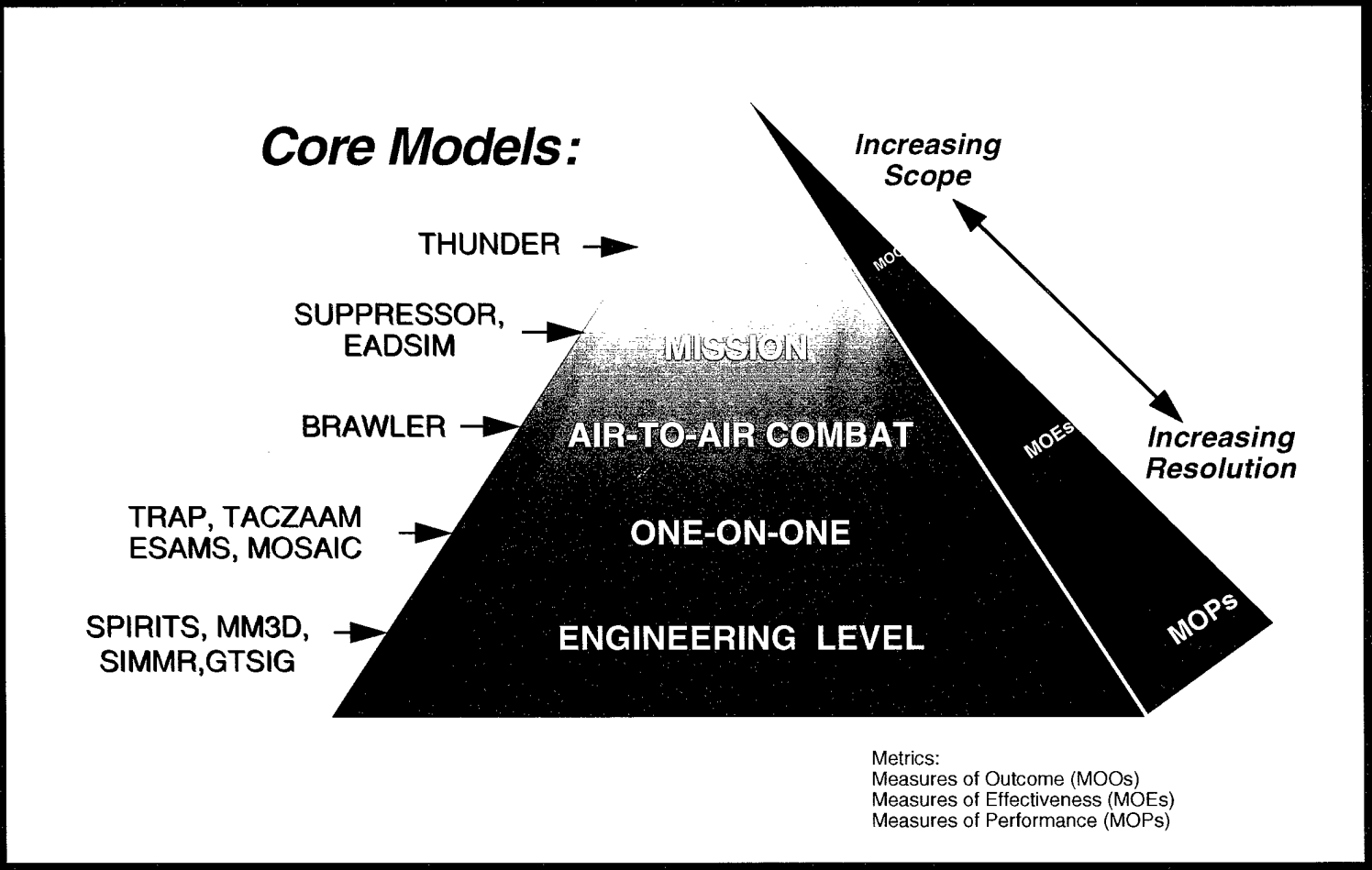
- **TRANSPORT AIRCRAFT**
  - IR SIGNATURE REDUCTION
  - IRCM
  - LOW ALTITUDE REGIME



# IR SAM SURVIVABILITY



# ANALYSIS AND MODEL HIERARCHY



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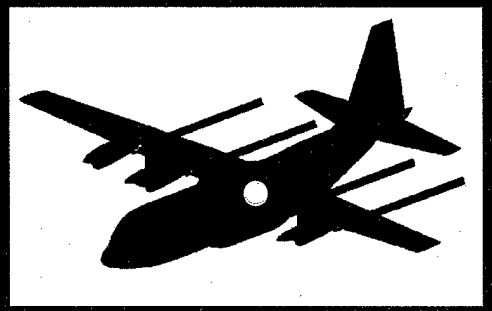
# MODELING FIDELITY AND COMPUTATIONAL BURDEN

14 days

hrs

min

## POINT SOURCE

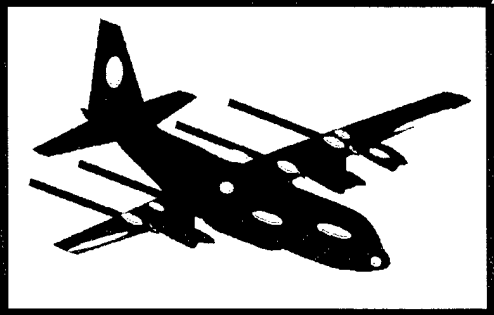


• QUICK & EASY

## AREA SOURCES (ELLIPSOIDS)

• WIREFRAME
• MULTIPLE SOURCES
• MOSAIC 1.4 or 2.0

## IMAGE SOURCES (GRAPHIC RADIANCE MAPS)

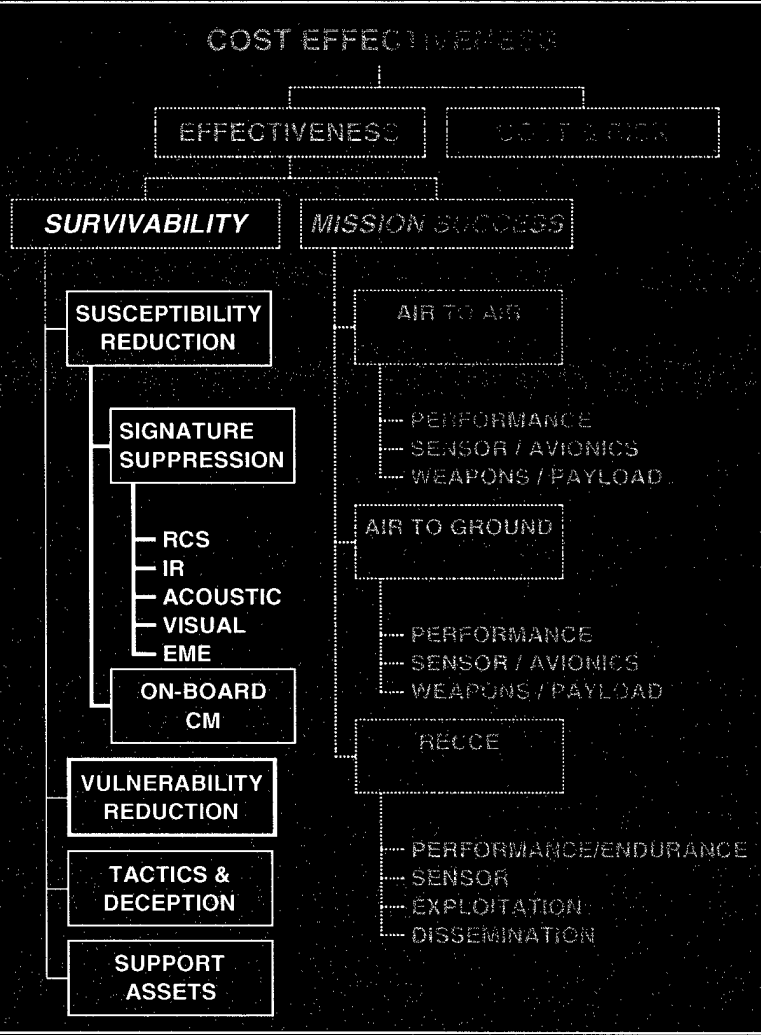


• INDIVIDUAL CONTRIBUTORS
• SEE WHAT MISSILE SEES
• TRUE EXTENDED SOURCES
• EDGES
• MOSAIC 2.0+

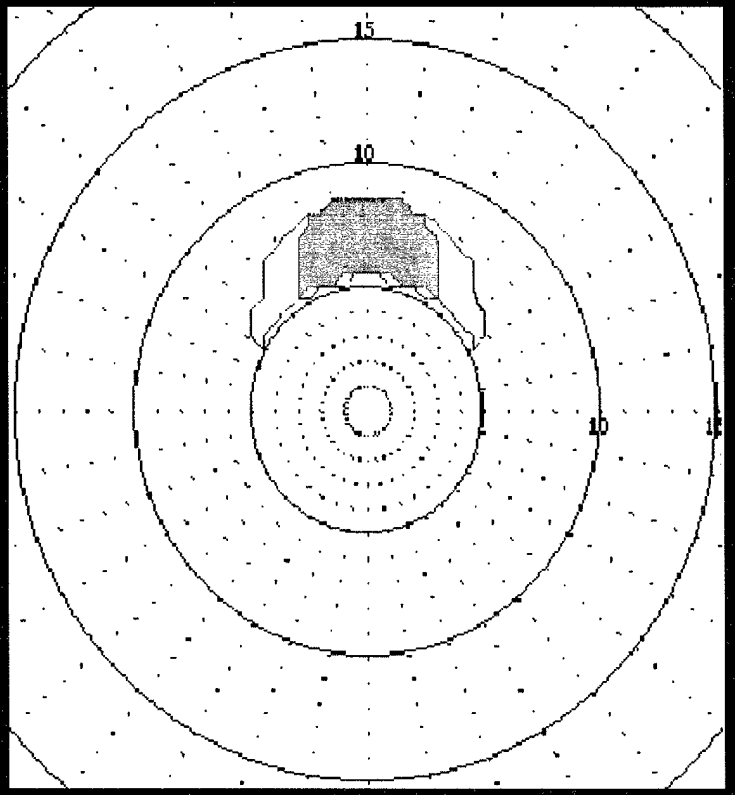
UNCLASSIFIED

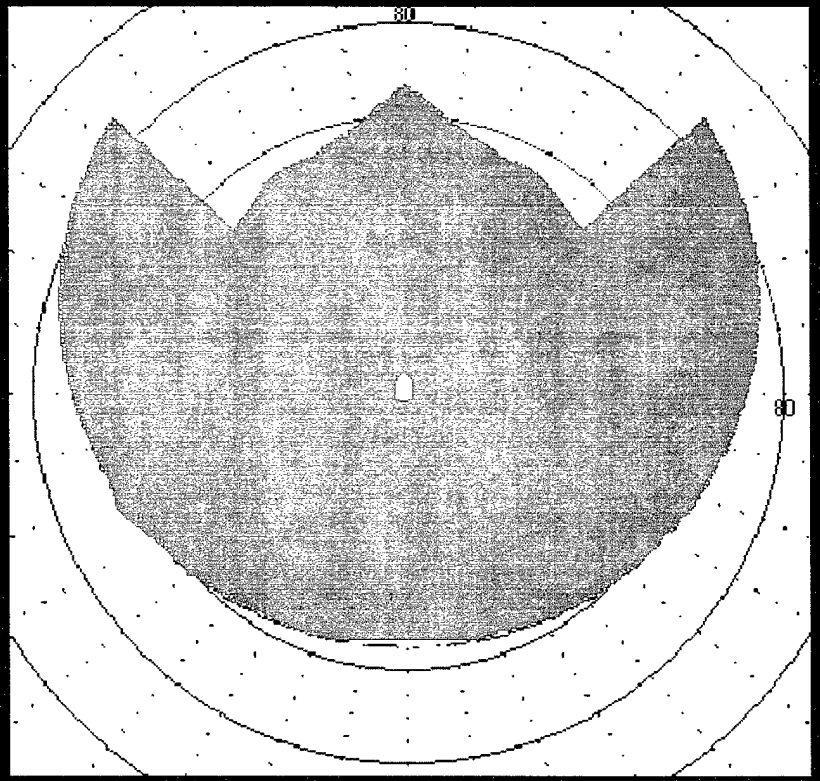
# VULNERABILITY REDUCTION

- **TRADITIONAL OBJECTIVES**
  - MAXIMUM HARDENING WRT AAA THREAT
    - **PROVIDES HARDNESS TO ALL THREATS**
  - NO OR MINIMUM IMPACT ON COST, PERFORMANCE, WEIGHT
  - PROVIDE GUIDANCE IN AIRCRAFT DESIGN
- **REFINED OBJECTIVES**
  - TRADE OFF HARDENING WITH DIMINISHED THREAT EFFECTS DUE TO CM



# TRADITIONAL VULNERABILITY REDUCTION OBJECTIVES FALL SHORT



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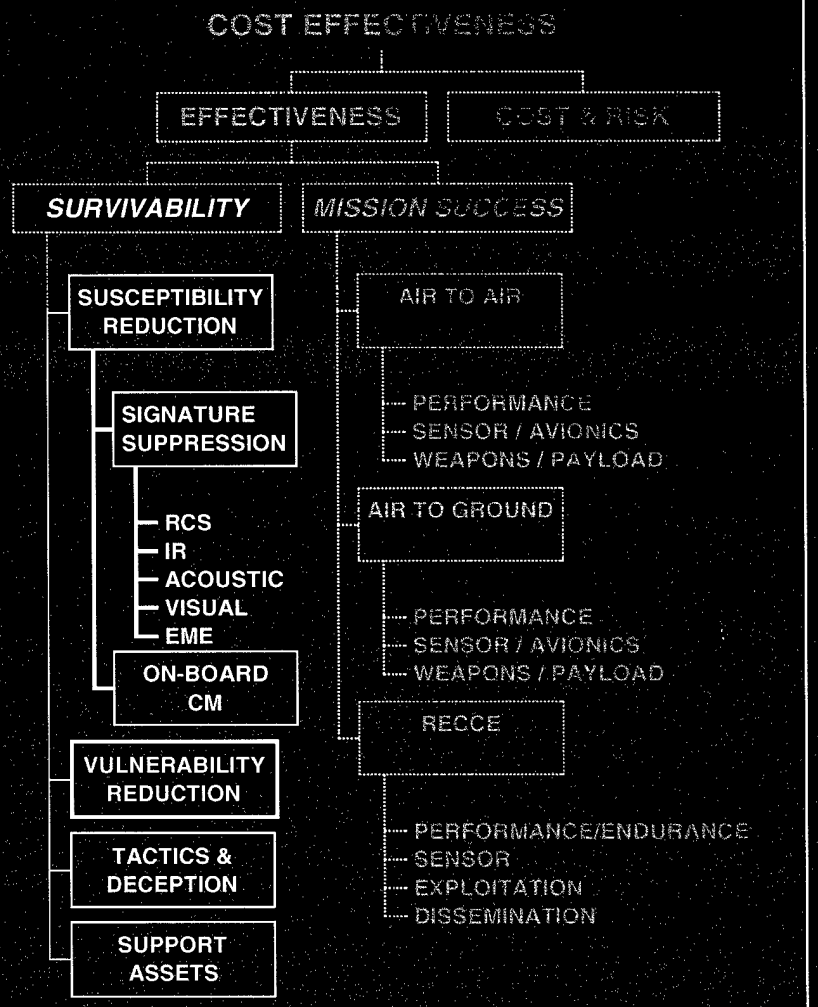


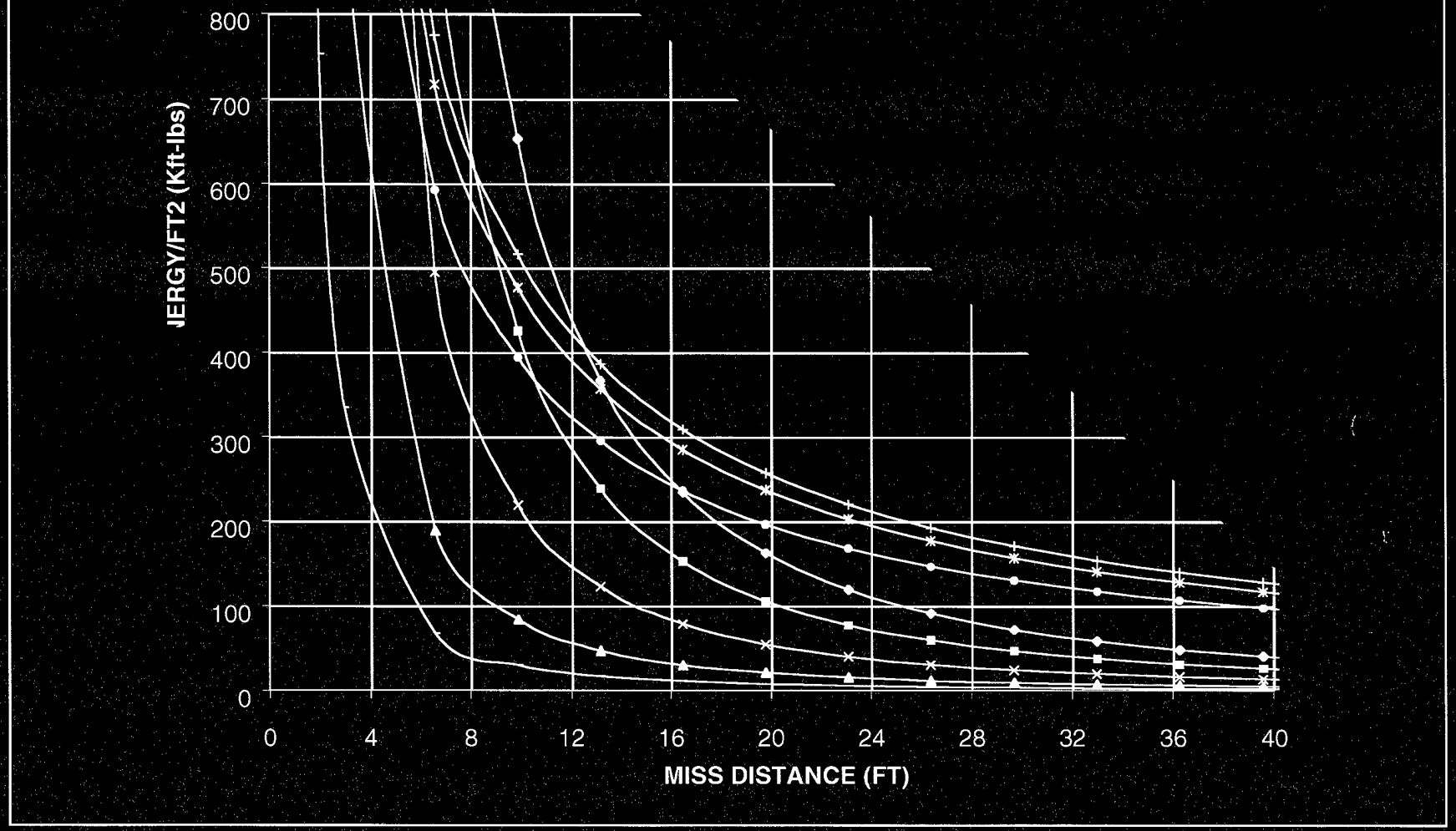
# *VULNERABILITY REDUCTION IN BALANCED SURVIVABILITY*

- **DEVELOP A SANCTIONED WARHEAD LETHAL RADIUS METHODOLOGY**
- **CONSIDER THREATS LIKELY TO BE ENCOUNTERED**
  - NOT 23MM HEI PROJECTILE AGAINST AN A/C AT 50 KFT
- **UNDERSTAND DAMAGE EFFECTS FROM WARHEAD DETONATION AT APPROPRIATE DISTANCES**
  - FRAGMENTS AS KILLERS OF STRUCTURE & OF INTERNAL COMPONENTS; FRAGMENTS AS FIRE INITIATORS; BLAST EFFECTS ON STRUCTURE

# WARHEAD LETHAL RADIUS INCONSISTENCIES

| | Weight | Charge | Frag | Frag Vo | Frag # | Angle | Radius | KJ/ft$^2$ |
|---|---|---|---|---|---|---|---|---|
| **H** | 73 | 36.3 | 1.94 | 1900 | 16700 | 75 | 21.9 | 0.7 |
| **P** | 73 | 30 | 1.94 | 1900 | 21480 | 90 | 27.4 | 0.4 |
| **3** | 73 | 40.6 | 4.67 | 2240 | 4530 | 41 | 11.0 | 7.5 |
| **5** | 217 | 90 | 2/3.5 g | 1200 / 1800 | 16000 / 21000 | 120 | 25.0 | 0.8 |
| **2** | 192 | 121 | 7.06 | 2800 | 8000 | 15 | 29.9 | 7.0 |
| **1** | 130 | 75 | 2.5 | 2700 | 22000 | 30 | 30.5 | 2.2 |

# THREAT ENERGY PER UNIT AREA VS MISS DISTANCE



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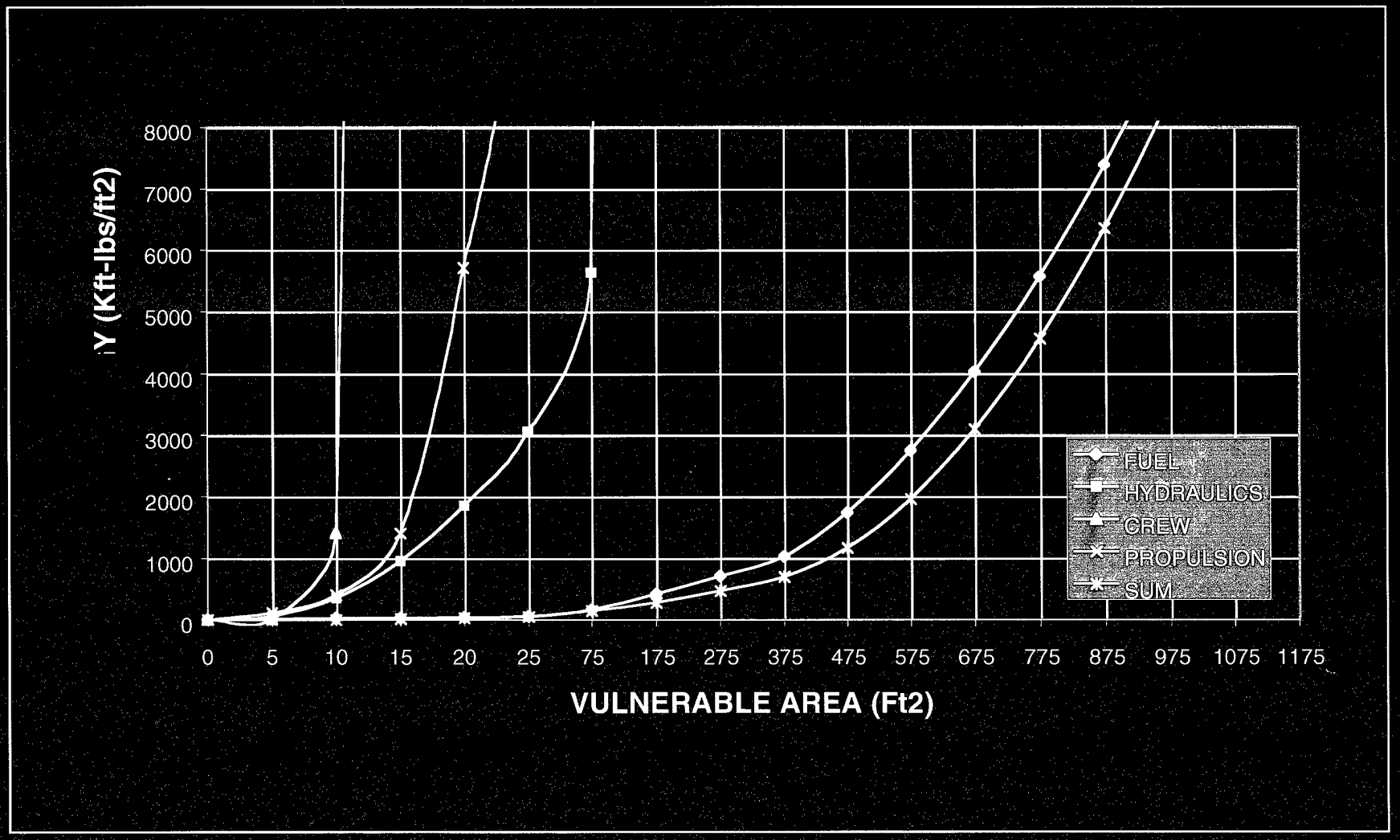
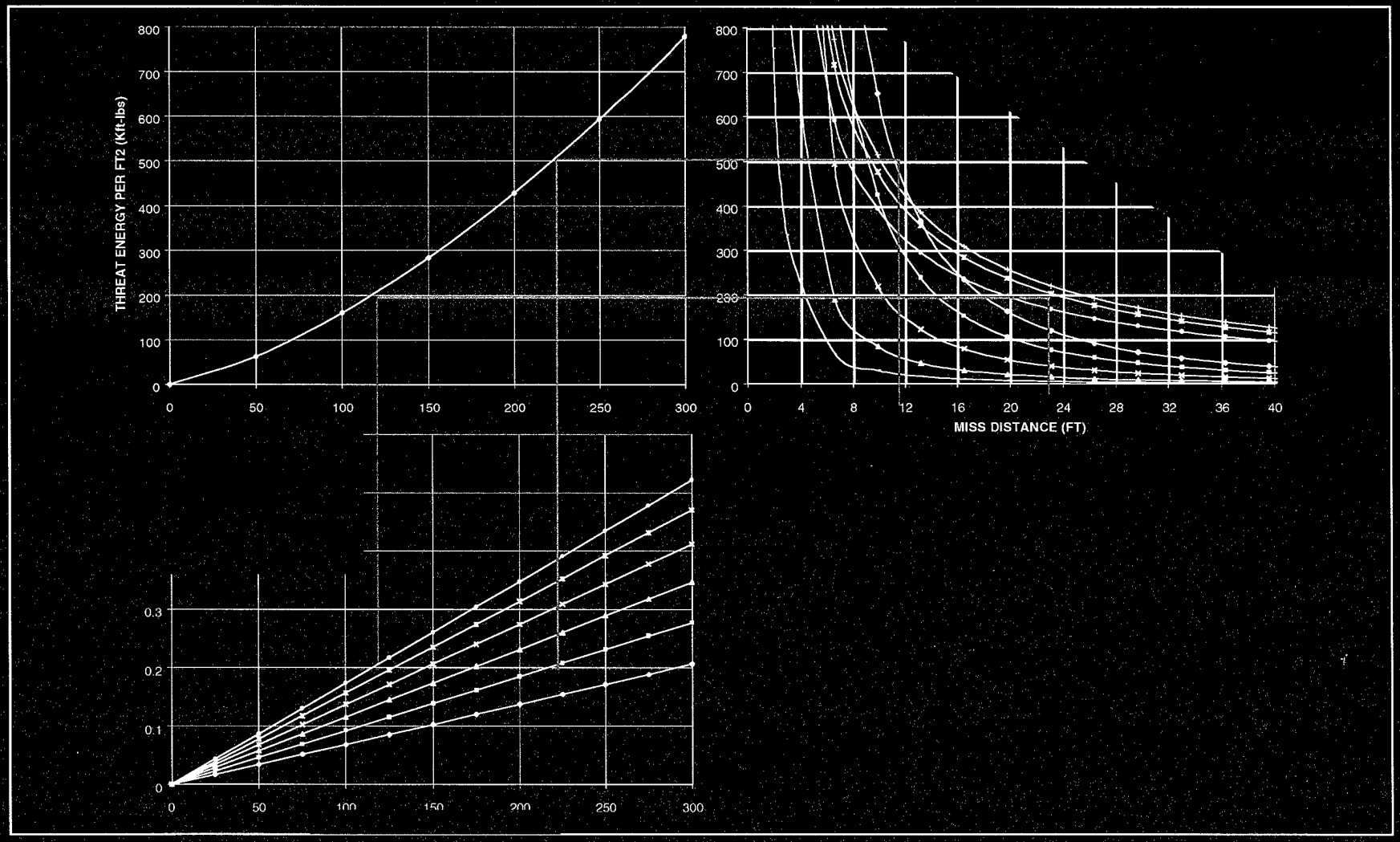
# THREAT ENERGY VS VULNERABLE AREA



# WARHEAD LETHAL RADIUS NOMOGRAPH



# THE CRITICAL ELEMENT: COST

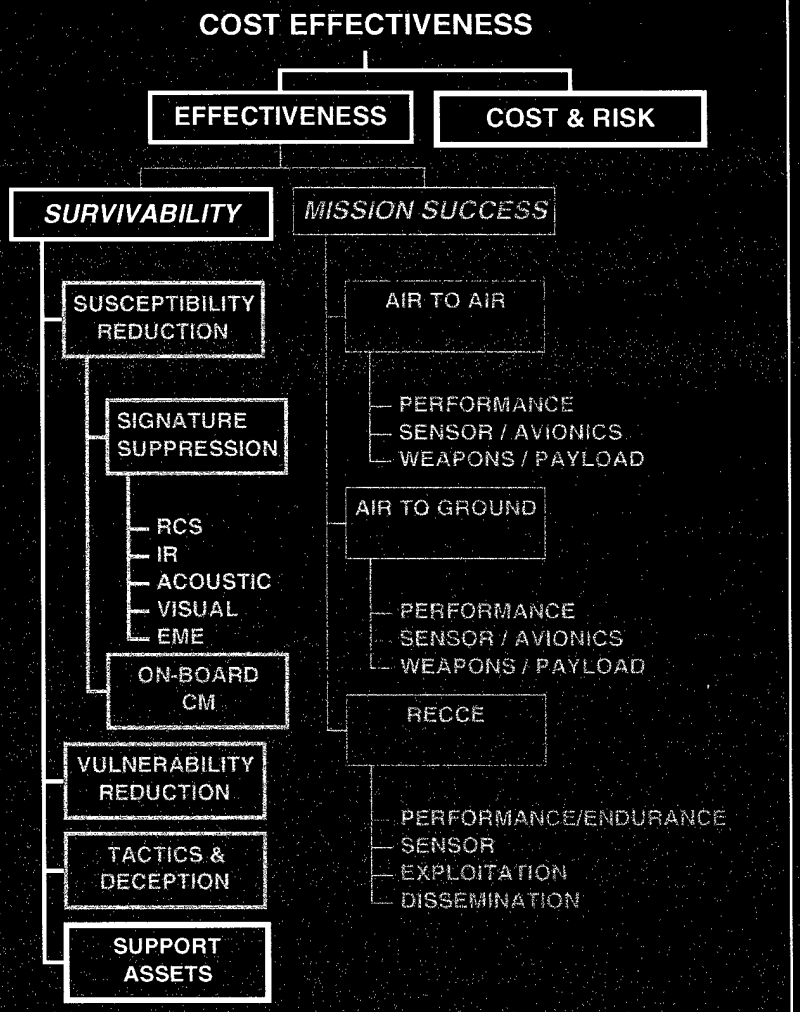
- **PRESENTED IN VARIOUS FORMS TO ADDRESS FINANCIAL AND SUBJECTIVE ISSUES**
  - FLY-AWAY COST - OUT OF POCKET...
  - LIFE CYCLE COST - IN THE LONG RUN...
  - CAIV - WHAT CAN I BUY FOR...
  - AFFORDABILITY - ...

# THE CRITICAL ELEMENT: COST

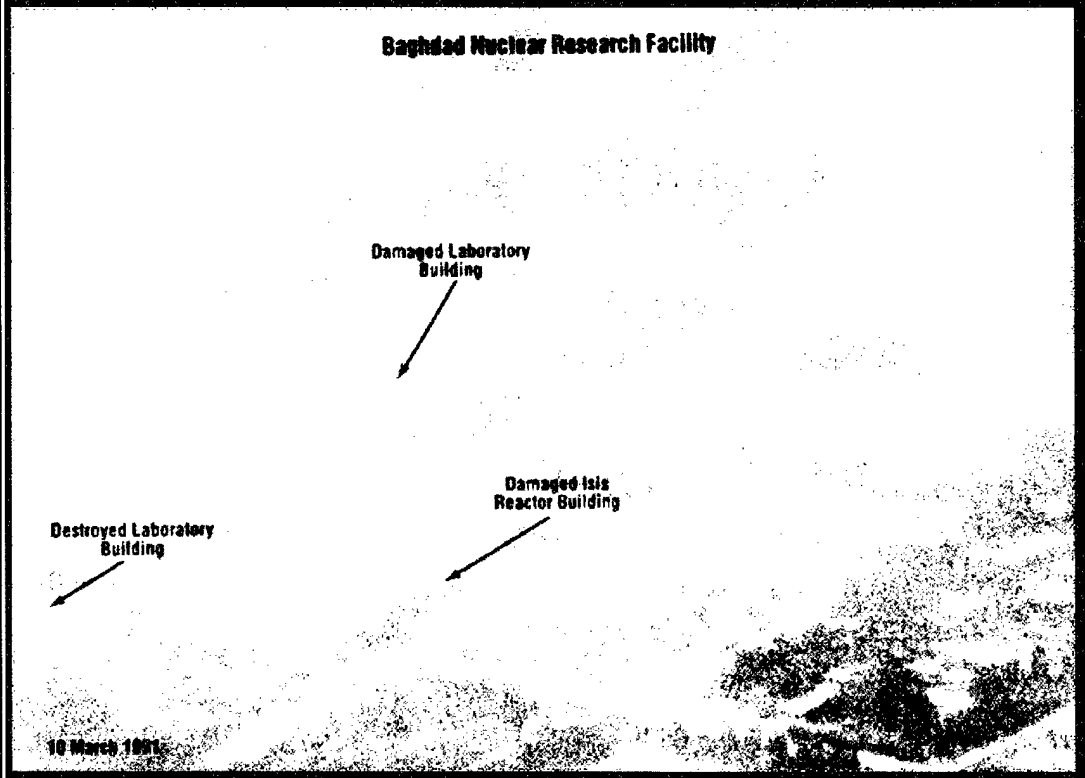
- **COST OF MISSION SUCCESS (AND FAILURE) IS A FUNCTION OF PRIORITIES, STRATEGY, NATIONAL RESOLVE**
  - APOLLO
  - MANHATTAN PROJECT
  - ...
- **WEAPON SYSTEM COST MUST BE CONSIDERED IN THE CONTEXT OF MISSION SUCCESS.**

# THE CRITICAL ELEMENT: COST

- **RELIANCE ON EXTERNAL SYSTEMS FOR SURVIVABILITY , COMMITS THE USER TO MAINTAIN / UPGRADE / REPLACE THE SUPPORT ASSETS IN INVENTORY.**
  - CRUISE MISSILE STRIKES & SEAD
  - HIGHLY SURVIVABLE AIR-TO-GROUND SYSTEMS
  - HIGHLY SURVIVABLE AIR-TO-AIR SYSTEMS
  - STAND-OFF JAMMERS
  - TANKERS



# COST OF MISSION SUCCESS




| | | |
|---|---|---|
| STRIKE | 32 | 8 |
| F-15 | 16 | |
| EF-111 | 4 | |
| F-4G | 8 | |
| TANKER | 15 | 2 |
| AIRCRAFT | 75 | 10 |
| LOSSES | 2 | 0 |
| AIRCREW | 72 - 132 | 8 - 16 |
| ASSETS | $2,328M | $597M |
| SORTIE COST | $7,949K | $956K |
| ACQ. | $9,073M | $1,756M |

# THE COST OF MISSION SUCCESS

- **ONLY WEAPON SYSTEMS THAT ARE, IN THEMSELVES, SURVIVABLE AND EFFECTIVE OFFER THE PROMISE OF LOW COST IN MISSION SUCCESS.**
  - THEY ALSO HAVE THE POTENTIAL TO REDUCE THE TOTAL WEAPONS SYSTEM INVENTORY.
- **MOE'S MUST REFLECT THE CONTRIBUTION OF ALL SYSTEMS BROUGHT TO BEAR IN A MISSION.**
  - COST AND BENEFIT